BEST PRACTICE EVIDENCE BASED GUIDELINE

MANAGEMENT OF ASTHMA IN CHILDREN AGED 1-15 YEARS.

2005

PAEDIATRIC SOCIETY OF NEW ZEALAND

HEALTH OF OUR CHILDREN: WEALTH OF OUR NATION

WWW.PAEDIATRICS.ORG.NZ

STATEMENT OF INTENT

Clinical guidelines are produced to assist health professionals and consumers make decisions about health care in specific clinical circumstances. Research has shown that if properly developed, communicated and implemented, guidelines can improve care. While guidelines represent a statement of best practice based on the latest available evidence (at the time of publishing), they are not intended to replace the health professional's judgment in each individual case.

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Where guidelines are modified for local circumstances, significant departures from these national guidelines must be detailed with reasons for the departure. The Paediatric Society Guidelines Group cannot be held responsible for such changes.

BASIS OF GUIDELINE

This guideline is based on the paediatric sections of the British Guideline for he Management of Asthma 2002 produced jointly by the Scottish Intercollegiate Guideline Network (SIGN) and the British Thoracic Society. The full version of the British Guideline and its updates on which the New Zealand guideline is based are available from www.sign.ac.uk.

This Guideline has a currency of 3 years from date of publication unless superseded.

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As this guideline was developed by the Paediatric Society under contract with the Ministry of Health the review of the guideline remains the responsibility of the Ministry.

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ENDORSEMENTS

Endorsements for this guideline were received from:

Endorsed by NZGG as a best-practice guideline

ACKNOWLEDGEMENTS

We are very grateful to all members of the Guideline Development Team for their contributions.

The guideline team thanks Susan Bidwell of NZHTA for her work and advice. Thanks also to Catherine Marshall and Rowena Cave of NZGG for their support and advice in developing this guideline and to Professor David Holdaway and Carolyne Smith for their assistance with editing.

We are also indebted to all the groups and individuals who made comments on the draft.

PURPOSE

This guideline addresses the assessment, diagnosis and management of asthma in children and young people aged 1-15 years inclusive.
The guideline summarises the latest international literature and combines this with New Zealand expertise. The purpose is to assist informed decision making by parents/caregivers and their health care providers in order to improve the health outcomes for children and young people with asthma.

This guideline does not address young people 16 years and over and adults – refer to the Diagnosis and Treatment of Adult Asthma (NZ Guidelines Group 2002) ISBN:0-473-08827-4.

This guideline complements the Paediatric Society of New Zealand Guideline for the Diagnosis and Management of Wheeze and Chest Infection in children under 1 year (2004).

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ABOUT THE GUIDELINE

FOREWORD

The Paediatric Society of New Zealand Inc (PSNZ) is a not-for-profit charitable organisation. It was founded in 1947 in recognition of the special developmental and health needs of children. Until 2000 it remained largely a professional support organisation for paediatricians. In 2000 it moved to become a multidisciplinary organisation in recognition of the crucial role played by all groups of child health professionals in achieving its mission. PSNZ is committed to improving the health of children and young people. As a multi-disciplinary Society we are able to develop and influence pathways for improvement.

"HEALTH OF OUR CHILDREN: WEALTH OF OUR NATION."

The PSNZ is a national organisation working to:

- be consistent with the UN Convention on the Rights of the Child
- advocate for the health, well-being and social environment of children and young people
- plan for the development of all aspects health care for children and young people and consider how services inter-link with each other
- promote quality health care and disease prevention initiatives for children and young people
- establish standards, guidelines and position statements
- provide and publish information for health care professionals and the public on matters that concern the health and welfare of children and young people

INTRODUCTION

The publication of the New Zealand Guideline for the Diagnosis and Treatment of Adult Asthma in 2002 highlighted the lack of a similar guideline for children. This document seeks to redress that gap.

THE BASIS OF THE GUIDELINE

This guideline is based on the paediatric sections of the British Guideline for the Management of Asthma 2002 produced jointly by the Scottish Intercollegiate Guideline Network (SIGN) and the British Thoracic Society. The document is available from www.sign.ac.uk. This is the full version and the updates on which the New Zealand guideline is based and to which the reader should refer for the evidence base and rationale for recommendations.

The New Zealand Guideline Development Group applied the AGREE Tool to assess The British Guideline. It was assessed as being a systematically developed evidence based guideline. The SIGN evidence grading system has been used for this guideline.

Some areas identified by the AGREE assessment required adaptation to reflect the New Zealand context, particularly in relation to Maori and Pacific people and to the availability of drugs and drug doses.

The topic of spacers and nebulisers for acute asthma required further updating in accordance with the Cochrane Systematic Reviews 2004. The appropriate recommendations have been updated accordingly http://www.update-software.com/Abstracts/AB000052.htm.

The New Zealand Guideline for the Diagnosis and Treatment of Adult Asthma (2002)[1], and the Asthma Guideline for Children and Young People Procare, Starship Children's Hospital Kidz First and University of Auckland (2002)[2] were used for guidance where this guideline differs from the British Guideline[3],.

CURRENT OUTCOMES FOR CHILDREN*

The outcomes for children and young people with asthma in New Zealand need improvement. Hospitalisation rates in young children are several fold higher than those in adults. There is a need to see a reduction in hospital admission rates in children, especially pre-school children.[4] It is important that the day to day impact of asthma on the lives of children and their families is optimised so that they have:

- minimal symptoms
- no absences from school and pre-school due to asthma
- no restriction of normal activities

It is important that existing disparities in outcome are reduced so that all children enjoy the lesser morbidity experienced by others in the population.

While guidelines on the management of asthma can be standardised, the approach to the care of individuals requires consideration of their unique situation, culture and needs.

* Children in the document refers to all individuals between the age of 2 and 18 years.

HOW MUCH EFFORT IS NEEDED TO ADDRESS THE ISSUES?

This guideline is intended as a framework within which health professionals can examine their approach to asthma management in children and young people, and note where their current practice differs from the recommendations in this document. Management which leads to excessive morbidity is the responsibility of everyone involved in delivering asthma care. Involvement of the child, young person and their family is essential in this process so that they are well informed and are partners in the management process.

IS THERE A REASONABLE LIKELIHOOD THAT THE RECOMMENDED CHANGES COULD BE IMPLEMENTED ?

The recommendations in this document have been written to give straightforward guidance on management. All components are available at: www.paediatrics.org.nz
There are three components to this document:

1. Laminated A4 sheets with a summary of key flowcharts
2. The New Zealand version of the guideline for quick reference, available in hard copy
3. The full document which is only a web based version - it is the full version of the British Guideline and its updates, available on www.sign.ac.uk

Audit tools are recommended (see page 42)

SIGN GRADING SYSTEM

The SIGN grading system has been used in this guideline and is explained below.

LEVELS OF EVIDENCE

1++	High quality meta analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well conducted meta analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1 -	Meta analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2++	High quality systematic reviews of case-control or cohort studies High quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal
2+	Well conducted case control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
2 -	Case control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal
3	Non-analytic studies, e.g. case reports, case series
4	Expert opinion

GRADES OF RECOMMENDATION

A	At least one meta analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or A systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+

Good practice points

☑	Recommended best practice based on the clinical experience of the guideline development group

GUIDELINE DEVELOPMENT PROCESS

In 2001 the PSNZ received a contract from the Ministry of Health requiring various outputs including the development of evidence based guidelines for common conditions. The Society undertook an internal prioritisation process and the guideline for the management of asthma was identified as one of the five to be developed.

A review of recent guidelines was undertaken for their appropriateness for children and young people and it was agreed that the British Guideline for the Management of Asthma was the most recent and most comprehensive guideline reviewed. Permission was sought to adapt this guideline for New Zealand.

GUIDELINE DEVELOPMENT TEAM

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DECLARATION OF COMPETING INTERESTS

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GlaxoSmithKline, funding to attend European Respiratory Society Annual Scientific Meetings, and major financial support for research programme
Merck Sharp and Dohme, funding to attend European Respiratory Society Annual Scientific Meetings, and financial support for research programme
AstraZeneca support for research programme

David Barry

Glaxo-Smith-Kline ERS Stockholm 2002 Registration/ Accommodation

Viv Isles

Funding for travel and conference fees from Glaxo-Smith-Kline and a scholarship in 2002 and 2003 from Glaxo-Smith-Kline/College of Nursing for Masters Study.

Jim Reid

Astra Zeneca Medical Advisory Committee
GlaxoSmithKline ERS Geneva 2000: registration and hotel at conference
Director Best Practice Advocacy Centre (NZ)
Director Best Practice Advocacy Centre (Inc)

Ian Shaw

Glaxo-Smith Kline funded to attend European Respiratory Society meeting 2003
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Participant in Seretide trial 2000
PSNZ Representative on PTAC Respiratory Subcommittee

All other members declared no conflict of interest.

CONSULTATION

A draft guideline was circulated to approximately 110 organisations and individuals, to all members of the Paediatric Society. It was made available on: www.paediatrics.org.nz.

Comments were received from:

Asthma & Respiratory Foundation of New Zealand

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INTRODUCTION TO ASTHMA MANAGEMENT

SMOKING

Parents[†] and parents-to-be who smoke should be advised of the many adverse effects of smoking on their children, including increased wheezing in infancy, and be offered appropriate support to stop smoking.	**B**

• Exposure to tobacco smoke in the home contributes to severity of childhood asthma. • Smoking as a teenager increases the risk of persisting asthma • Smoking cessation should be encouraged.	☑

• Ask about smoking in the household, and record this information.	☑

DIAGNOSIS

Asthma should be suspected in any child with wheezing, ideally heard by a health professional on auscultation, and which is distinguished from upper airway noises.	☑

Recurrent cough in the absence of wheeze is unlikely to be due to asthma.	☑

Base the diagnosis of asthma on: • the presence of key features and careful consideration of alternative diagnoses • assessment of the response to trials of treatment, and ongoing assessment • repeated reassessment of the child, and question the diagnosis if management is ineffective (Appendices 1 &2).	**D**

Key features include: (Appendices 1&2) • wheeze and breathlessness with or without cough • variation in intensity and duration • child experiences symptom-free periods.	☑

The presence of atopic disease in the child or immediate family increases the chance of asthma.	☑

Record the criteria on which the diagnosis is made.	☑

[†] Parents throughout this document refers to biological, foster, and step parents as well as whanau and caregivers with other arrangements.

WHERE THE DIAGNOSIS OF ASTHMA IS UNCERTAIN

A trial of bronchodilator should be considered when asthma is suspected and the child is breathless. Try salbutamol MDI and spacer up to 6 puffs under 5 yrs, up to 12 puffs 5 years or older. Check clinical response 20 minutes later.	☑

There is currently insufficient evidence to define the optimal dose of salbutamol in children five years and older. The NZGG Guideline for the Diagnosis and Management of Adult Asthma[1] recommends a dose of 8 puffs and the British Guideline[3] recommends 10 puffs. However, in Australasia, some units use a dose of 12 puffs.

EXERCISE-INDUCED ASTHMA (EIA)

For children **over five years** an inhaled short-acting ß$_2$ agonist, immediately prior to exercise, is the drug of choice.	**A**

For children **under five years** an inhaled short-acting ß$_2$ agonist, immediately prior to exercise, is the drug of choice.	☑

Dose of inhaled short-acting ß$_2$ agonists is 2 puffs.	☑

Warm up prior to exercise is recommended.	☑

If symptomatic with EIA, regardless of other medications, preventive treatment should be reviewed.	☑

If exercise is a specific problem, despite low dose inhaled corticosteroid, go to Step 3 in the Stepwise Management flow chart.	☑

ASSESSMENT OF ASTHMA CONTROL

History – ask about • Waking at night with cough or wheeze • Ability to exercise • Attendance at school/preschool • Amount of β2 agonist used.	☑
Examination – look for • Weight and height percentiles • Signs of airway obstruction in "interval phase" • Chest deformity.	☑
Consider • Symptom diary • Lung function testing >6 yr.	☑

Lung function measurements cannot be reliably used to guide asthma management in children under 5 years of age.	☑

PEAK FLOW

Reliable monitoring with peak flow meters (even in clinical drug trials) is poor. There is little evidence of their value as a long-term monitoring tool, but this does not negate the use of home monitoring and charting at critical times. These include, for example:

- at diagnosis and initial assessment
- when assessing response to changes in treatment
- when monitoring response during exacerbations as part of an asthma action plan
- with children who are poor perceivers of airway obstruction.

Cautions:

- long periods of monitoring often result in fabrication of recordings
- unjustifiable reliance on the results
- peak flow meters vary in their readings
- one reading in a child who has not previously used a meter is not reliable.

AIMS OF MANAGEMENT

1. minimal symptoms during day and night
2. minimal need for reliever medication
3. no exacerbations
4. no limitation of physical activity
5. normal lung function

NON-PHARMACOLOGICAL MANAGEMENT

There is increasing interest in factors which, if avoided, facilitate the management of asthma and may have the potential to modify fundamental causes of asthma. However, evidence of efficacy is lacking for many approaches and more studies are required. For further details see www.sign.ac.uk.

PHARMACOLOGICAL MANAGEMENT

Some of the drugs recommended by the British Guideline are not currently on the Pharmaceutical Schedule in New Zealand. Despite this the Guideline Development Team has endorsed their place in the management of asthma based on the evidence provided in the British Guideline.

THE STEPWISE APPROACH TO LONG TERM MANAGEMENT

A stepwise approach aims to abolish interval symptoms as soon as possible by starting treatment at the level most likely to achieve this. The aim is to achieve early control of symptoms, to maintain control by stepping up treatments as necessary, and stepping down when control is good (see Figure 1 pg 24).

1. Start treatment at the step most appropriate to initial severity
2. Achieve early control of symptoms including waking from sleep and exercise limitation
3. Maintain control by:
    - stepping up treatment when control is poor
    - stepping down when control is good

STEP DOWN

Regular review of patients as treatment is stepped down is important. When deciding which drug to step down first and at what rate, take the following into account: • the severity of asthma, • the side effects of the treatment, • the beneficial effect achieved, • the child's preference	☑

Children should be maintained at the lowest possible dose of inhaled steroid. Reduction in inhaled steroid dose should be slow as patients deteriorate at different rates. Reductions should be considered every three months, decreasing the dose by approximately 25-50% each time.	☑

Remember that topical steroids for rhinitis and eczema have an additive effect on total body daily dose.	☑

The preventer medication needs to be titrated against clinical response to ensure optimum efficacy.	☑

In many children under 5 years back titration is especially important as symptoms of asthma may not represent persistent asthma.	☑

MILD INTERMITTENT ASTHMA (STEP 1)

Most children have mild intermittent asthma, with episodes of symptoms requiring treatment less often than once every 1-2 months, and these episodes are usually of mild severity (see pgs 25 & 26).

Children with mild intermittent asthma should be treated with inhaled short acting β_2 agonists as needed	☑

REGULAR PREVENTER THERAPY (STEP 2)

The exact threshold for introduction of regular preventer therapy has never been firmly established.

Inhaled steroids should be considered for patients with any of the following: • exacerbations of asthma in the last two years • using inhaled $\beta_2$2 agonists three times a week or more • symptomatic three times a week or more • waking one night a week.	☑

For steps 2, 3, and 4 (see Algorithm One pg 25), treatments have been judged on their ability to improve symptoms, improve lung function, and prevent exacerbations, with an acceptable safety profile. Improvement of quality of life, while important, is the subject of too few studies to be used as the basis of recommendations at present.

INHALED CORTICOSTEROID (ICS)

The primary treatment to control persistent asthma is inhaled corticosteroid (ICS) Unlike asthma in adults, some younger children with intermittent asthma symptoms will not have persistent asthma.

Many children under the age of 5 years with wheezing episodes with colds will not continue to wheeze as they grow older Thus particular attention is required to the stepping down and the weaning off if control is very good. Some children may have troublesome wheezing only for part of the year in a particular season and it would be appropriate to use ICS for those months of the year rather than the whole year round.

Inhaled corticosteroids are the recommended preventer drug for children for achieving overall treatment goals.	**A**

Dosage

Doses of fluticasone propionate (FP) are half those of beclomethasone dipropionate (BDP) and budesonide (BUD) eg FP 50mcg is equivalent to 100mcg of BDP or 100 mcg of BUD. Some formulations of ICS do not allow exact equivalency between brands. It is recommended to round down rather than up to avoid upwards dosage creep.

Starting dosage

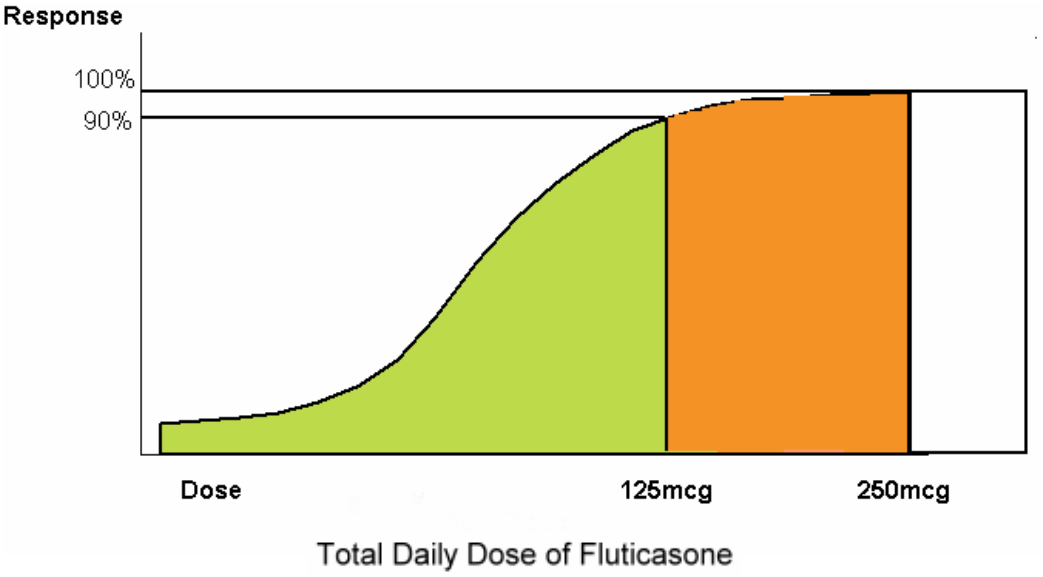
In mild to moderate asthma, starting at high doses of inhaled steroids and stepping down confers no benefit. Start patients at a dose of inhaled steroids appropriate to the severity of disease.

- in children 200 mcg BDP equivalent per day is the usual starting dose at any age

Maintenance dosage

In children under 5 years, higher doses may be required if there are problems in obtaining consistent drug delivery.
Titrate the dose of ICS to the lowest dose at which effective control of asthma is maintained.

Dose response curve for ICS



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The dose response curve above shows that at least 90% of the maximum benefit can be achieved with low doses of fluticasone 125mg/day (or BDP or Budesonide 250mcg/day) Most children will achieve a good response with these doses but some children with persistent poor control may need higher doses of ICS to achieve full control.

ADD ON THERAPY (STEPS 3 AND 4)

Add on therapy is indicated when control of symptoms with Step 2 treatment is not optimal.

LONG ACTING β 2 AGONISTS (LABAS)

Long acting β_2 agonists should not be used without inhaled corticosteroids.	☑

The maximal recommended dosage at all ages is

- Eformoterol 12mcg bd
- Salmeterol 50mcg bd

- In New Zealand, unlike other countries, a special authority or endorsement is often required for prescribing these medicines.

- In New Zealand LABA are available only under Special Authority Criteria, when patients have not been not well controlled for at least 3 months on moderate doses of ICS. The PHARMAC threshold doses for LABAs are higher than the British and other international guidelines, which makes adhering to the British stepwise approach more problematic for doctors and children with asthma and their families in New Zealand.

- LABAs are not licensed for use <4years (Salmeterol) and <6 years (eformoterol). Evidence for recommendations for the use of LABAs in children under 4 years is extrapolated from that for adults, with the assumption that the same principles apply. The use of licensed medicines for unlicensed indications is often necessary in paediatric practice when there is no suitable alternative. For Medicine Data Sheets and further information on the use of Unapproved Medicines consult "Medsafe" http://www.medsafe.govt.nz

- LABAs may be considered as an alternative for families of children aged 2-4 years who can't afford to pay for montelukast, in discussion with a paediatrician.

The first choice for add on therapy to inhaled steroids in children aged 5-15 years is an inhaled long acting β_2 agonist.	**B**

COMBINATION THERAPY WITH ICS AND LABAS

There is no difference in efficacy in giving ICS and LABA in combination or in separate inhalers.	**A**

Some children may find a combination inhaler more convenient.

LEUKOTRIENE RECEPTOR ANTAGONISTS

In all age groups Leukotriene Receptor Antagonists have some beneficial clinical effect as preventer therapy in those taking short acting β_2 agonists alone.

As add on therapy to ICS, Leukotriene Receptor Antagonists provide improvement in lung function, a decrease in exacerbations and an improvement in symptoms in all age groups.

The only New Zealand Registered Leukotriene Receptor Antagonist, montelukast, is not currently on the Pharmaceutical Schedule, which makes it difficult to adhere to the British stepwise approach as there is a moderate cost to the family for the drug.

Montelukast is licensed for children over 2 years of age.

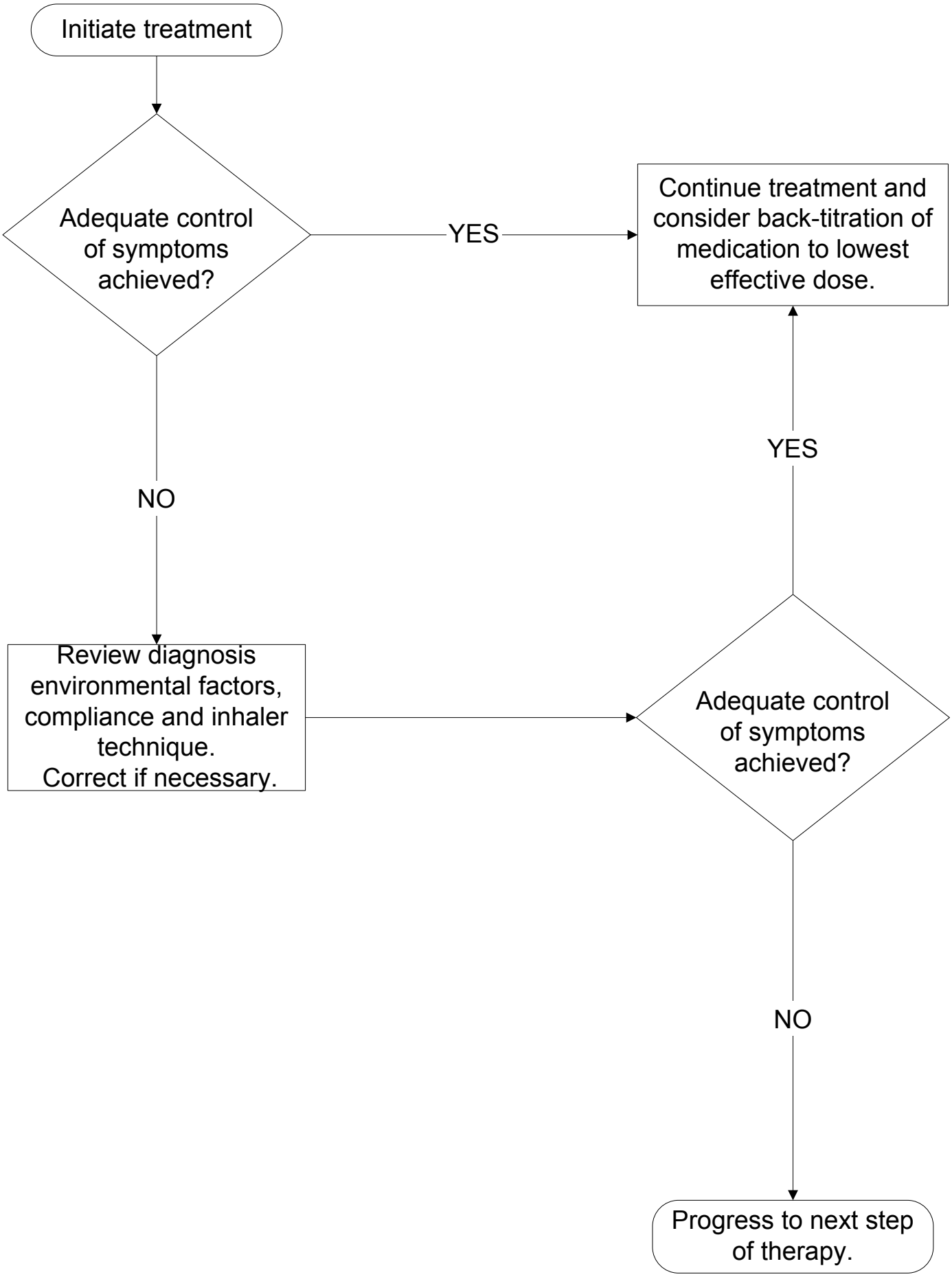
The recommended dose of montelukast is

- children 15 years of age & over, 10 mg tablet once a day in the evening
- children 6 to 14 years of age, 5 mg *chewable tablet* once a day in the evening
- children 2 to 5 years of age, 4 mg *chewable tablet* once a day in the evening

Figure One **MANAGEMENT OF CHRONIC ASTHMA**

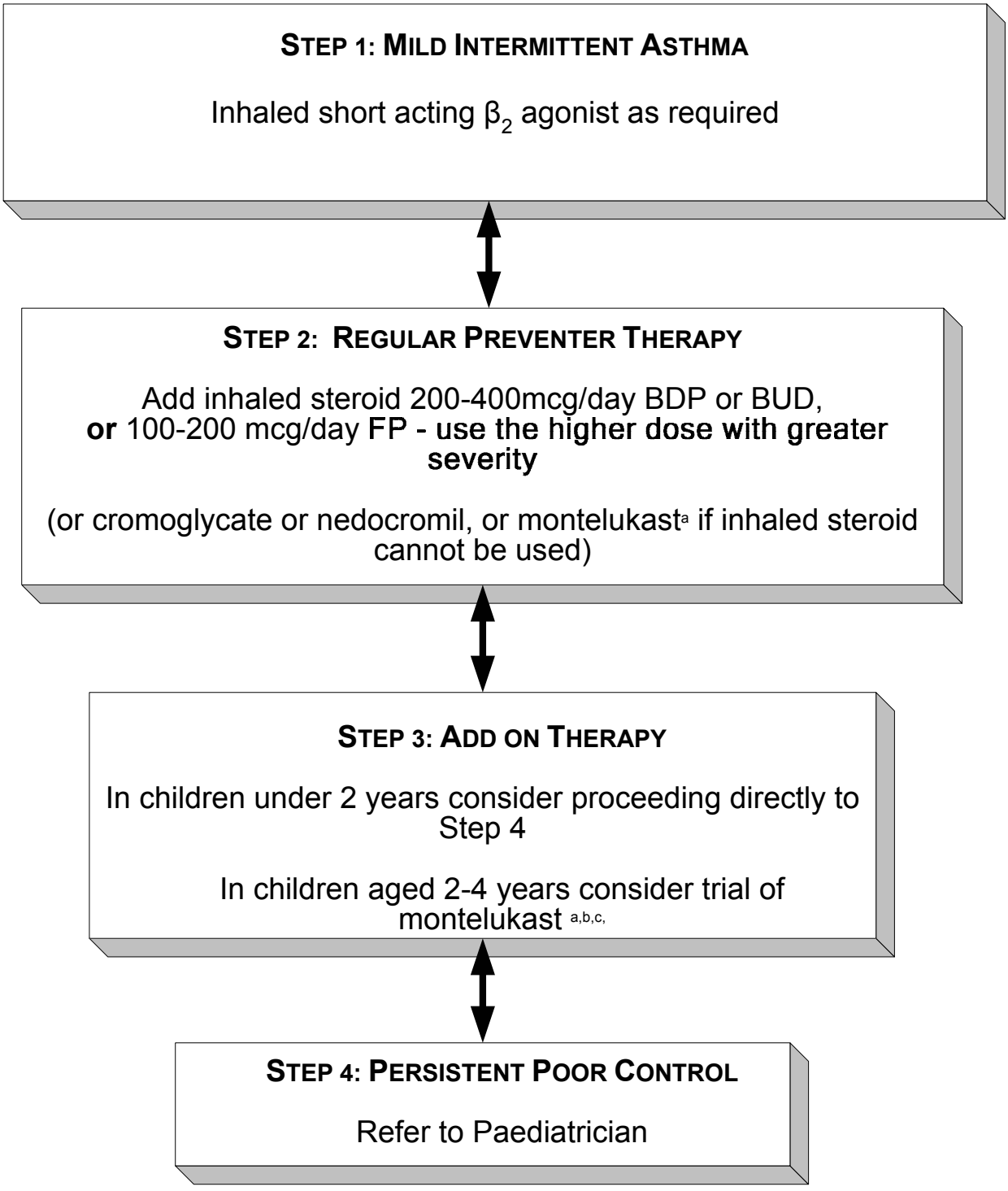
PROCESS OF REVIEW IN THE MANAGEMENT OF PERSISTENT ASTHMA.

Initiating or considering an increase in medication



Algorithm One

Summary of Stepwise Pharmacological Management in Children Aged 1- 4 Years.



a. The only New Zealand Registered Leukotriene Receptor Antagonist, montelukast, is not currently on the Pharmaceutical Schedule

b Montelukast as add on therapy is recommended before increasing the dose of BDP or BUD over 400mcg/day, or FP200 mcg/day.

c LABA's are not licensed for use <4years (Salmeterol) and <6 years (eformoterol), but are an alternative for families who can't afford to pay for montelukast.

- The use of licensed medicines for unlicensed indications is often necessary in paediatric practice when there is no suitable alternative.
- This should be in consultation with a paediatrician.
- For Medicine Data Sheets and further information on the use of Unapproved Medicines consult Medsafe: http://www.medsafe.govt.nz.
- Always need to take corticosteroid with LABA.

Algorithm Two

Summary of Stepwise Pharmacological Management in Children Aged 5-15 Years.

STEP 1: MILD INTERMITTENT ASTHMA

Inhaled short acting β_2 agonist as required

STEP 2: REGULAR PREVENTER THERAPY

Add inhaled steroid 200-400mcg/day BDP or BUD, or 100-200 mcg/day FP

- use the higher dose for greater severity,

(cromoglycate, nedocromil or montelukast[a] if inhaled steroid cannot be used)

STEP 3: ADD ON THERAPY

1. **Add inhaled long acting ß2 agonist (LABA)[b]**
2. **Assess response to LABA:**

- **good response to LABA** --- continue LABA

some benefit from LABA in maximum dose[c] but control still inadequate, increase inhaled steroid to 400mcg/day BDP or BUD, **or**

200 mcg/day FP (if not already on this dose)

- **no response to LABA -** Stop LABA consider trial of montelukast[a] **or** SR theophylline

STEP 4: PERSISTENT POOR CONTROL

Increase inhaled steroid to 600-800 mcg/day BDP or BUD, or 300-400 mcg/day FP[d]

Continue to review add on therapy

Refer to paediatrician if not improving

STEP 5: CONTINUED POOR CONTROL

Refer to paediatrician

Maintain high dose inhaled steroid

Consider steroid tablet in lowest dose providing adequate control.

a. The only New Zealand Registered Leukotriene Receptor Antagonist, montelukast, is not currently on the Pharmaceutical Schedule

b. The current Special Authority criteria of the Pharmaceutical schedule allows LABA to be introduced at the higher threshold of 400mcg/day BDP or BUD, or 200mcg/day

c. Maximum recommended dose of eformoterol is 12mcg bd, and salmeterol 50mcg bd

d. These levels of ICS are greater than usually required to achieve optimal control (See Dose Response Curve pg 21) and do not hesitate to seek advice from a paediatrician.

INHALER DEVICES

Inhaler device	< 2 years	2-4 Years	5-7 Years	8-15 years
MDI, small volume spacer & mask	Yes	Yes		
Dry powder inhaler			Possible	Yes
Auto-haler			Possible	Yes
MDI & spacer with no mask		Possible	Yes	Yes
MDI (alone)				Possible, not ideal

MDI = metered dose inhaler

GENERAL

Prescribe inhaler devices only after patients have received training in the use of the device and have demonstrated satisfactory technique.	☑
The child should have his/her ability to use an inhaler device assessed by a health care professional who is competent with the device.	☑
Reassess inhaler device technique regularly as part of the structured clinical review.	☑
The choice of device may be dictated by the choice of medication.	☑
If the child is unable to use a device satisfactorily, an alternative should be found. It is very unusual not to be able to find a suitable device.	☑
Younger children require close supervision of their inhaler technique	☑
Older children require monitoring of their inhaler technique	☑
A mouthpiece should be used in children aged 2–3 years or older, as lung delivery is two- to threefold higher for oral inhalation than by mask (nasal inhalation)	☑

SPACER AND MDI

Children aged ≥2 years with mild and moderate exacerbations of asthma should be treated by MDI + spacer with doses titrated according to clinical response.	**A**
Spacer and MDI are the preferred device for young children for acute and long term management.	☑
For efficient drug delivery from a spacer • Shake the MDI • The spacer should be loaded with one puff at a time and the child should take 4-6 tidal breaths per puff without delay. In older children a single vital capacity breath is equally good. • For multiple puffs, repeat the steps above	☑
In preschool children, small-volume spacers perform better than large-volume spacers.	☑
Detergent is the best antistatic agent for spacers, increasing lung delivery two- to threefold, but it **must not be** rinsed off. Wash with detergent once a week and drip dry	☑
In stable asthma for children over 5 years MDI and spacer is as effective as any hand held inhaler, but teenagers may prefer a dry powder inhaler	**A**
Nebulisers can be used for severe acute asthma children in any age group who are unable to comply with an MDI and spacer.	☑

DRY POWDER INHALER

In stable asthma a dry powder inhaler may be convenient for school and sport	☑
Some children in the 5-7 year age group may be able to use dry powder devices effectively.	☑

ACUTE ASTHMA

ACUTE ASTHMA SEVERITY TOOL

ACUTE MILD

- speaks/feeds normally
- pulse normal
- respiratory rate normal
- mild indrawing

ACUTE MODERATE

- speaking/feeding interrupted by breaths
- indrawing/accessory muscle use present
- pulse 1 to 5 years >110/min
  over 5 years >100/min
- respiration counted over 60 seconds
  1 to 5 years >40/min
  over 5 years >20/min

ACUTE SEVERE

- can't complete sentences in one breath, or too breathless to talk or feed
- pulse 1 to 5 years >130/min
  over 5 years >120/min
- respiration counted over 60 seconds
  1 to 5 years >50
  over 5 years >30
- indrawing/accessory muscle use obvious

ACUTE LIFE THREATENING

- hypotension
- exhaustion
- confusion
- coma
- silent chest
- cyanosis

Algorithm Three

Management of Acute Asthma

Assess severity

MILD
- Salbutamol MDI via spacer
- Consider prednisolone or prednisone based on history

MODERATE
- Salbutamol MDI via spacer.
- Prednisolone or prednisone
- Consider oxygen

SEVERE
- Oxygen.
- Salbutamol MDI via spacer or nebuliser
- Ipratropium MDI via spacer nebuliser.
- Prednisolone or prednisone

LIFE THREATENING
- **Remember ABC**
- **Oxygen high flow 8 litres/min**
- **Continuous Salbutamol Mdl via spacer or nebuliser**
- **IV Salbutamol 15mcg/kg over 10 minutes**

Transfer to Emergency Department with medical escort

Reassess Severity after 20 Minutes

MILD
- Repeat Salbutamol dose only if indicated
- Consider prednisolone or prednisone if not already given

MODERATE
- Repeat Salbutamol dose every 20 minutes for up to 1 hour
- Consider prednisolone or prednisone if not already given
- Consider oxygen

SEVERE
- Oxygen
- Repeat Salbutamol dose every 20 minutes as required
- If not improving use continuously.
- Repeat Ipratropium every 20 minutes up to 3 doses in 1st hour only

Reassess Severity after 1 hour if improving

If no improvement consider admission to hospital OR ICU if life threatening

DRUG DOSES IN ACUTE ASTHMA

- **Salbutamol MDI via spacer 100mcg per puff**
  - < 5 years 6 puffs
  - ≥5 years up to 12 puffs*
- **Salbutamol via nebuliser**
  - < 5 years 2.5 mg
  - ≥5 years 5 mg
- **Ipratropium MDI via spacer 20mcg per puff**
  - 4 puffs
- **Ipratropium via nebuliser 250mcg**
- **Prednisolone or prednisone**
  - 1-2 mg/kg/dose to a maximum of 40-60 mg.

* *There is currently insufficient evidence to define the optimal dose for children 5 yrs and older*

The following clinical signs should be recorded: • pulse rate – increasing tachycardia generally denotes worsening asthma; a fall in heart rate in life threatening asthma is a pre-terminal event • respiratory rate and degree of breathlessness i.e. too breathless to complete sentences in one breath or to feed • use of accessory muscles of respiration – best noted by palpation of neck muscles • amount of wheezing – which might become biphasic or less apparent with increasing airways obstruction • degree of agitation and conscious level – always give calm reassurance	☑

Note:

- **Clinical signs may correlate poorly with the severity of airways obstruction.**
- **Cough is not a marker of severity**
- **Some children with acute asthma do not appear distressed.**
- **In very severe asthma the chest may be quiet.**

CRITERIA FOR ADMISSION

Transfer children with severe or life threatening asthma urgently to hospital.	**A**
Treat children transported to hospital by ambulance with oxygen and nebulised $ß_2$ agonists during the journey.	☑
Consider intensive inpatient treatment for children who still have signs of acute severe asthma, or with SaO2 <92% (measured by pulse oximetry) on air after initial bronchodilator treatment (3 doses of 6 puffs under 5 yrs, up to 12 puffs 5 years or older of $ß_2$ agonists over one hour, or need for IV Salbutamol)	**B**
Transfer children with severe or life threatening asthma urgently to hospital to receive frequent doses of nebulised $ß_2$ agonists (2.5-5 mg salbutamol)	☑

TREATMENTS FOR ACUTE ASTHMA

OXYGEN

Children with acute severe or life threatening asthma, or SaO2 <92% should receive high flow oxygen (8 L/min) via a tight fitting face mask or nasal cannula at sufficient flow rates (2-3L/min) to achieve normal saturations	☑

INHALED ß2 AGONIST BRONCHODILATORS

Inhaled $ß_2$ agonists are the first line treatment. A MDI and spacer are the preferred option in mild and moderate asthma	**A**

Doses can be repeated every 20-30 minutes. Continuous nebulised β_2 agonists are of no greater benefit than the use of frequent intermittent doses in the same total hourly dosage, unless life-threatening acute attack.	☑

Individualise drug dosing according to severity and adjust according to the patient's response	**B**

For initial treatment see Algorithm 3	☑

Continuation treatment • Acute mild up to 6 puffs under 5 yrs, up to 12 puffs 5 years or older 4-6 hourly • Acute moderate up to 6 puffs under 5 yrs, up to 12 puffs 5 years or older every 4 hours • Acute severe up to 6 puffs under 5 yrs, up to 12 puffs 5 years or older every 3- 4 hours	☑

If needing doses more often than 3 hourly, refer to hospital	☑

In hospital frequency of dosing (1-4 hourly) will depend on severity	☑

ORAL ß2 AGONISTS

Oral β_2 agonists for treatment of asthma symptoms should be discouraged in all age groups because the onset of action is slow (30-60 minutes), they are relatively ineffective, and the incidence of behavioural side-effects and sleep disturbance is relatively high.	☑

STEROID THERAPY

Give prednisolone or prednisone early in the treatment of acute asthma attacks.	**A**
Use a dose of prednisolone or prednisone 1-2mg/kg/day. A maximum dose of 40mg per day is usually sufficient but up to 60mg may be used.	☑
Repeat the dose of prednisolone/ prednisone in children who vomit within an hour of the dose, and consider IV steroids hydrocortisone 4mg/kg/dose six hourly	☑
Treatment with systemic steroids for up to three days is usually sufficient, but tailor length of course to the number of days necessary to bring about recovery. Tapering of short courses (up to 7-14 days) of steroids is not necessary.	☑

INHALED CORTICOSTEROIDS (ICS)

There is insufficient evidence to support the use of ICS as alternative or additional treatment to steroid tablets for acute asthma. There is no evidence that increasing the dose of ICS is effective in treating acute symptoms, but it is good practice for children already receiving ICS to continue with their usual maintenance doses.

Do not initiate inhaled corticosteroids in preference to steroid tablets to treat acute childhood asthma.	☑
There is no evidence that increasing the dose of inhaled corticosteroid is beneficial in acute attacks of asthma.	☑
Betamethasone (Betnesol) and Dexamethasone are not recommended for use with asthma.	☑

IPRATROPIUM BROMIDE

There is good evidence for the safety and efficacy of frequent doses of ipratropium bromide used in addition to β2 agonists for the first two hours of a severe asthma attack. Benefits are more apparent in the most severe patients.

Nebulised ipratropium bromide should be added to nebulised $ß_2$ agonist treatment for patients with acute life threatening asthma or those with a poor initial response to $ß_2$ agonist therapy.	**A**
Consider inhaled ipratropium bromide in combination with an inhaled β2 agonist for more severe symptoms.	**B**
If symptoms are refractory to initial $ß_2$ agonist treatment, add ipratropium bromide (250 mcg/dose mixed with the nebulised $ß_2$ agonist solution).	**A**
In clinical practice 80mcg of ipratropium bromide in MDI and spacer is approximately equivalent to 250mcg in a nebuliser.	☑
Repeated doses of ipratropium bromide should be given early to treat children poorly responsive to $ß_2$ agonists – give first dose if acute severe or no improvement after 3 doses in one hour of inhaled $ß_2$ agonist (see algorithm 3)	☑
Repeated doses of ipratropium bromide should stop once the child has sustained clinical improvement.	☑

OTHER THERAPIES

Routine prescription of antibiotics is not indicated in acute asthma.	☑
Aminophylline is not recommended in children with mild to moderate acute asthma.	**A**
Tiotropium bromide is not recommended in children with acute asthma.	☑

ACUTE LIFE THREATENING ASTHMA

The early addition of a bolus dose (over 1-2 minutes) of IV salbutamol (15 mcg/kg) can be an effective adjunct to treatment in acute life threatening and acute severe asthma. Close monitoring is required.	**B**
Consider IV aminophylline in an high dependency unit or paediatric intensive care unit setting for children with severe or life threatening bronchospasm unresponsive to maximal doses of bronchodilators and systemic steroids.	**C**
If IV salbutamol infusion is considered admit to intensive care or high dependency unit for paediatric dosage and monitoring	☑

ORGANISATION AND DELIVERY OF CARE

ROUTINE CARE

Proactive routine clinical review of children with asthma is associated with favourable clinical outcome including reduced school absence, a reduced exacerbation rate and improved symptom control. It is difficult to be prescriptive about the frequency of review as this will vary with the severity of the disease. Outcome is similar whether a practice nurse or a general practitioner conducts the review. Clinicians trained in asthma management achieve better outcomes for their patients. Routine reviews carried out by telephone may be as effective as those using face-to-face consultations.

All children with asthma should have access to primary care delivered by clinicians with appropriate training in asthma management.	**B**
In primary care, children with asthma should be reviewed regularly by a nurse or doctor with appropriate training in asthma management.	**B**
Health professionals who provide asthma care for children should have the knowledge and skills to manage the specific problems of childhood illness and disability .	☑
Routine care should be provided by the nominated primary health care provider. New Zealand Handbook Health and Disability Sector Standards (Children and Young People) Audit Workbook (SNZ HB 8134.4:2004)[5.]	☑
Care provided across all parts of the health system: (primary, after-hours, hospital and community) should interconnect well, with timely clear communication between providers, with copies to parents/caregivers. SNZ HB 8134.4:2004[5.]	☑
Children in all parts of the health services should be cared for in accordance with the SNZ HB 8134.4:2004[5.]	☑
Discharge from hospital or the emergency department should be a planned, supervised event.	**B**
All children attending hospital with acute exacerbations of asthma should be reviewed by a clinician with expertise in asthma management, preferably within 30 days.	**B**

PATIENT EDUCATION, SELF MANAGEMENT AND ACTION PLANS

Written personalised action plans as part of self-management education have been shown to improve health outcomes for people with asthma The evidence is particularly good for those in secondary care with moderate to severe disease, and those who have had recent exacerbations , with reduction in hospitalisations and emergency department attendances in people with severe asthma. A consistent finding in many studies has been improvement in patient outcomes such as self-efficacy, knowledge and confidence.

Prior to discharge from hospital children and their caregivers[‡] should receive individualised asthma action plans, given by clinicians with appropriate training in asthma management.	**A**
Children with asthma should be offered self-management education that should focus on individual needs, and be reinforced by a written action plan.	**A**
Introduce asthma action plans as part of a structured educational discussion.	**B**
Any child with asthma management on Step 2 or greater should have an asthma action plan.	☑
An acute consultation offers the opportunity to determine what action the child and family has already taken to deal with the exacerbation. Their self-management strategy may be reinforced or refined, and the need for consolidation at a routine follow up considered.	☑
A consultation for an upper respiratory tract infection, or other known trigger, is an opportunity to rehearse self-management in the event of their asthma deteriorating.	☑
Brief simple education linked to child/family goals is most likely to be acceptable to the them.	☑

Plans can be written in many ways, some can be downloaded from NZ website:
http://www.adhb.govt.nz/asthma/
http://www.asthmanz.co.nz/
and from overseas: http://www.ginasthma.com/

[‡] Caregivers in this context refers to all who participate in the care of the child including family, extended family, schools and early childhood centres.

Written Information

Leaflets may assist in education. Written information is available from the websites of ARFNZ: http://www.asthmanz.co.nz AND Parent to Parent: www.everybody.co.nz/support/parent.html.	☑

CONCORDANCE AND COMPLIANCE

PRACTICAL TIPS FOR IMPROVING COMPLIANCE

- Ask open-ended questions like "If we could make one thing better for your asthma what would it be?" This may help to elicit a more patient-centred agenda
- Make it clear you are listening and responding to the patient's concerns and goals
- Reinforce practical information and negotiated treatment plans with written instruction
- Consider reminder strategies
- Recall patients who miss appointments

Identify child/parent goals for treatment.	☑

Check the child/family's understanding and experience of asthma – are there misunderstandings, bad experiences, fears, panic, or dependency which need discussing and addressing?	☑

Provide simple, verbal and written instructions and information on treatment for children and carers, and check their understanding.	☑

Identify barriers to quality asthma management (e.g. financial, parent's work, parent's other responsibilities, housing, transport, telephone, literacy, language, stresses at home, number of caregivers, provider preference).	☑

Prescription counting is a useful index of compliance.	☑

DEVELOPMENTAL CONSIDERATIONS

Caring for children and young people requires a highly skilled response from personnel who understand developmental needs within a family and have communication skills to

- understand and manage the specific problems of childhood illness and disability
- understand and relate to children, young people and the whole family
- provide care and support via a multi-disciplinary team[5].

Care should be provided in accordance with the SNZ HB 8134.4:2004[5]

The Preschool Child (1-5 Years)

Pre-school children who have on-going experience of asthma can, when supported by their parents, be taught self-management skills.	☑
Developmentally appropriate language and play can facilitate the learning of these skills.	☑

The Older Child (6-11years)

Children of this age also have valuable understandings and skills in regard to their asthma treatment and management. They should therefore be included in a developmentally appropriate way in discussions regarding their illness and its management.	☑
Some parents may give too much responsibility to the child for monitoring and treating their asthma.	☑

The Young Person (over 12years)

The transition to self management for a young person with asthma is a process that requires active management for all concerned, including young people, their families and providers	☑
Young people have differing states of physical maturity, cognitive abilities, identity, independence and autonomy that change through the teenage years. This is critically important in designing effective interventions to promote asthma self care.	☑
Some young people with long standing asthma are poor perceivers of their symptoms.	☑
Young people with asthma are at least as likely to engage in health risking behaviours (including smoking) as their peers.	☑

Psychosocial risk factors are a significant predictor of asthma morbidity and mortality. Positive youth development requires consideration of the bigger picture. Environments, schools, peers and families are significant influences on the health of young people. Poorly controlled asthma may occur if the whole context of the young person is not fully addressed.	☑

Transition to adult services is a planned and graduated process (occurring over several years) and is essential before transfer occurs. It involves relevant services and is responsive to the wishes and abilities of the young person. [5]	

MAORI CHILDREN WITH ASTHMA

The burden of paediatric asthma falls heavily on Maori. Although the prevalence of paediatric asthma in New Zealand is similar for Maori and non-Maori,[6] Maori children with asthma:

- have more severe symptoms when presenting to the health provider for routine or acute care[6]
- require hospitalisation almost twice as often as non Maori children [6,7,8]
- require more time off school because of asthma[8]

Despite an increased need, Maori children with asthma appear to be disadvantaged when it comes to adequate asthma care. They are less likely to receive adequate education, to have an asthma action plan and to be prescribed preventive medication.[9,10,11]. Other commonly cited barriers for Maori with asthma include the cost for consultation, access to transport and telephone and the attitude of the doctor/provider, including bias and discrimination.[8,12]. Provision of affordable, accessible and appropriate asthma care is the responsibility of funders and service providers. Barriers to quality asthma care must be identified and eliminated.[13]

Policy writers and health providers must also recognise the social, economic and political factors that impact on the health of Maori children with asthma. Improvements in the socio-economic, housing, education and political status of Maori will subsequently advance the wellbeing of Maori children with asthma.

Finally, an integrated approach to asthma care is required.[14] Such an approach will include:

- accurate diagnosis
- education
- action plans
- regular review of medication
- addressing barriers
- coordination between primary and secondary services
- supporting whanau

Where possible, Maori strategies at each of these steps must be supported and promoted. Examples include Tu Kotahi Maori Asthma Society, customised Action Plans, and Auahi Kore programmes to help parents quit smoking. New or novel approaches to asthma care that incorporate Maori initiatives must be developed.

Recognise that asthma burden falls heavily on Maori children	☑
Eliminate differences in the provision of care to Maori children with asthma	☑
Recognise the social, economic and political factors that impact on the well being of Maori children	☑
Support the development of Maori asthma initiatives	☑
Support whanau in the care and management of asthma for Maori children.	☑

PACIFIC (PACIFIKA) CHILDREN WITH ASTHMA

The following recommendations are made to acknowledge the role of the extended family and the cultural values of Pacific people and the way in which Pacific people respond to and access health services

Fanau involvement is vital to ensure compliancy. Involve everyone that takes care of the child, including the aoga and teachers (language nest).	☑
Provide education about how the medications work – lack of understanding leads to not taking their preventer.	☑
Ensure that language is not a barrier. For people that do not communicate in English or any people who speak English as a second language, consider using an interpreter. A trained health professional is preferred and ensure child/fanau consent prior to any meeting.	☑
Consider partnership with a local Pacific Health Provider	☑
Actions plans with pictures of medicines rather than words may help.	☑

AUDIT TOOLS

Evidence suggests that guidelines alone do not affect clinical practice. Feedback based on audit is useful both as part of an implementation strategy and for longer term positive influence on practice. The recommendations below are intended to assist in auditing the recommendations contained in the guideline.

Monitoring indices required by the Ministry of Health must be kept and audited by the health care provider

- annual hospital admissions
- readmissions to hospital
- accurate recording of ethnicity data
- mortality
- provided with a current asthma action plan

In addition presentation to emergency departments for acute asthma should be monitored.

General practices should maintain a list of people with asthma	**C**
Clinical review should be structured and utilise a standard recording system	**C**
Feedback of information to clinicians should link individual patients with recommendations from guidelines	**B**

Measures for a practice audit on the care of children with asthma

A. Practice procedures

- policies are in place regarding repeat prescribing for asthma medication
- spacers are used in acute asthma in the practice.
- policies are in place for the rapid assessment and treatment of children with acute asthma
- policies are in place for at least annual formal assessment of asthma including
  - inhaler Technique including use of spacers
  - ICS dosage
  - review of action plan
- health professionals undertake continuing professional education in paediatric asthma
- the practice identifies frequent attenders for “respiratory tract infections”
- the practice monitors outcomes of acute asthma
- the practice monitors acute exacerbation rate (including treatment at EDs) and hospital admission rate of children with asthma.

B. Prescribing audit

- ratio of number of reliever devices / preventer devices prescribed (this can be sourced from Best Practice Advocacy Centre of New Zealand http://www.jr2.ox.ac.uk/bandolier/band119/b119-6.html
- percentage of children with asthma taking 800mcg BDP equivalent or more who are not taking LABA
- identify high users of short acting inhaled $ß_2$ agonist.

APPENDIX 1

ALTERNATIVE DIAGNOSES IN WHEEZY CHILDREN

See the Guideline on Wheeze and Chest Infection in infants under 1 year (Paediatric Society of New Zealand 2005)

- intermittent wheezing attacks are usually triggered by viral infection
- the differential diagnosis of wheezing includes:
  - -aspiration pneumonitis
  - -bronchiolitis
  - -pneumonia
  - -bronchiectasis
  - -inhaled foreign body
  - -tracheomalacia
  - -complications of underlying conditions such as congenital anomalies and cystic fibrosis
- prematurity and low birth weight are risk factors for recurrent wheezing

Clinical clue*	**Possible diagnosis***
Perinatal and family history	
• symptoms present from birth or perinatal lung problem	• cystic fibrosis, chronic lung disease of prematurity, ciliary dyskinesia, developmental anomaly
• family history of unusual chest disease	• cystic fibrosis, developmental anomaly, neuromuscular disorder
• persistent sinusitis	• defect of host defence
Symptoms and Signs	
• persistent wet cough	• cystic fibrosis, recurrent aspiration, bronchiectasis, host defence disorder
• excessive vomiting or spilling	• reflux (± aspiration)
• dysphagia	• swallowing problems (± aspiration)
• abnormal voice or cry	• laryngeal problem
• focal signs in the chest	• developmental anomaly, post adenoviral pneumonia, bronchiectasis, tuberculosis
• inspiratory stridor as well as wheeze	• central airway or laryngeal disorder • inhaled foreign body
• failure to thrive	• cystic fibrosis, host defence disorder, gastroesophageal reflux
• clubbing	• bronchiectasis, cystic fibrosis
Chest Xray	
• focal radiological changes	• developmental anomaly, inhaled foreign body, bronchiectasis, tuberculosis, segmental or lobar collapse
• persistent radiological changes	• recurrent aspiration, bronchiectasis,cystic fibrosis

*List not comprehensive

APPENDIX 2

Note: Recurrent cough in the absence of wheeze is unlikely to be due to asthma

ALTERNATIVE DIAGNOSES IN COUGHING CHILDREN

Clinical clue*	Possible diagnosis*
History	
• day care	• recurrent bronchitis
• unimmunised	• pertussis
• symptoms present from birth or perinatal lung problem	• cystic fibrosis, ciliary dyskinesia, developmental anomaly
• family history of unusual chest disease	• cystic fibrosis, developmental anomaly, neuromuscular disorder
• persistent upper respiratory tract disease	• defect of host defence
Symptoms and Signs	
• recurrent cough, asymptomatic between episodes	• recurrent bronchitis, tracheomalacia, mild airway compression
• paroxysmal cough	• pertussis
• persistent wet cough	• cystic fibrosis, recurrent aspiration, bronchiectasis; host defence disorder
• excessive vomiting or spilling	• reflux (± aspiration)
• dysphagia	• swallowing problems (± aspiration)
• abnormal voice or cry	• laryngeal problem
• focal signs in the chest	• developmental anomaly, post adenoviral pneumonia, bronchiectasis, tuberculosis
• inspiratory stridor as well as wheeze	• central airway or laryngeal disorder
• failure to thrive	• cystic fibrosis, host defence disorder; gastroesophageal reflux
• older child	• psychogenic cough, tobacco smoking
• clubbing	• bronchiectasis, cystic fibrosis
Chest Xray	
• focal radiological changes	• developmental anomaly, inhaled foreign body, bronchiectasis, tuberculosis, segmental or lobar collapse
• persistent radiological changes	• recurrent aspiration, bronchiectasis, cystic fibrosis

*List not comprehensive

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5 New Zealand Handbook Health and Disability Sector Standards Children and Young People Audit Workbook SNZ HB 8134.4:2004

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